

Danube, Staffordshire, William Fairbairn, Pendragon, Odalisk, and Paolo Revello, some of which suffered severely.

At 5 A.M. on the 15th, the *Staffordshire*, in about $18^{\circ} 30'$ S. and 61° E., was thrown on her beam ends, and in great danger of foundering. The *William Fairbairn*, a fine iron vessel of 1,293 tons, lost all her masts and sails, and had her decks almost completely swept. On the 13th, in $19^{\circ} 2'$ S., and $64^{\circ} 40'$ E., she had a strong gale from S.E., which increased to a hurricane. About 7 P.M. her barometer was at 28.70 , and early on the 14th the wind shifted from S.E. to N.W. The *Paolo Revello*, on the 14th, in $18^{\circ} 8'$ S. and $61^{\circ} 54'$ E., was completely gutted. The captain's papers and log-book, cabin furniture, &c., together with the chief officer and nine men, were washed overboard.

From the logs hitherto received it appears that the storm was formed between the S.E. trade-winds, and the N.W. monsoon from the 7th to the 9th. On the 10th the centre was in $13^{\circ} 10'$ S. and $78^{\circ} 30'$ E.; on the 12th in $15^{\circ} 6'$ S. and $71^{\circ} 34'$ E.; on the 14th in $17^{\circ} 15'$ S. and $63^{\circ} 28'$ E.; on the 16th in $20^{\circ} 7'$ S., and $55^{\circ} 50'$ E.; and on the 18th in $22^{\circ} 15'$ S. and $51^{\circ} 50'$ E. During the first six days it travelled on a W.S.W. course, and then curved a little towards the south. It passed about 165 miles north of Rodrigues at noon on the 14th, about 65 miles north of Mauritius early on the 16th, and N.N.W., &c., of Reunion from noon on the 16th to noon on the 17th. Its average rate of progression was nine miles an hour, and the area over which the wind blew from strong breezes to hurricane violence was about 800 miles.

The fact that in this, as in other storms, the wind at Mauritius did not veer more than twelve points, seems to be explained by the incurving of the air towards the centre.

On the evening of the 15th, or morning of the 16th, seventeen vessels put to sea from the roadsteads of Reunion, and their fate is not yet known. If they held to the N.W., with the wind from S.E., they probably got into the heart of the storm.

CHARLES MELDRUM

Mauritius, March 8

P.S.—The aurora seen here on the night of the 4th to 5th February, was also seen at sea by several vessels. Here are extracts from their logs:—

Olive Branch in $27^{\circ} 47'$ S. and $59^{\circ} 48'$ E.—“At 10 P.M. the sky became very red and fiery—southern lights.”

Abbotsford in $30^{\circ} 9'$ S. and $56^{\circ} 10'$ E.—“Dull atmosphere. Aurora australis reflecting brightly in the south, giving light over all the ship. Clouds tinged with deep red.”

Elizabeth in $20^{\circ} 33'$ S. and $78^{\circ} 3'$ E.—“At 10 P.M. Aurora australis unusually bright.”

Gladiateur in $30^{\circ} 32'$ S. and $57^{\circ} 28'$ E.—“At 8 P.M. a red and yellow and strange looking sky. Midnight, sky the same.”

Pendragon in $13^{\circ} 43'$ S. and $84^{\circ} 13'$ E.—“At midnight very suspicious-looking weather to the S., the sky being quite red.”

William Fairbairn in $32^{\circ} 57'$ S. and $60^{\circ} 2'$ E.—“At 10 P.M. looking ugly, and meteorological signs of a hurricane. Midnight same, and up till 3 A.M. when it cleared off.”

Caton in $31^{\circ} 31'$ S. and $108^{\circ} 10'$ E.—“Midnight, red sky, like fire to E.S.E.”

Oleander in $38^{\circ} 26'$ S. and $31^{\circ} 53'$ E.—“From 7.30 to 11.30 P.M. the sky was illuminated with a very brilliant Aurora australis.”

There is little doubt that the suspicious-looking weather to the S., seen by the *Pendragon* in about 14° S., was the aurora. Captain McKenzie of the *W. Fairbairn* reports that his standard compass was affected to the extent of $\frac{3}{4}$ of a point, and his other compass to the extent of two to three points.

C. M.

PHYSICAL SCIENCE IN GLASGOW UNIVERSITY

THE Physical Laboratory of Glasgow University, which till quite lately was the only one in this country, dates from the year 1852. It was with difficulty that room could be found for a laboratory of any kind in the old building; but in the new building, of which this is the second year of habitation, considerable space has been set apart for Experimental Natural Philosophy.

At present six rooms belong to the department, exclusive of the Professor's private sitting-room and the store-rooms, and on the completion of the tower, which is not yet finished, additional rooms will be devoted to it. The whole suite of rooms is arranged so as to be in direct communication with those of the professors of mathematics, engineering, and astronomy.

The chief lecture-room is 42ft. long by 35ft. broad, its side windows look nearly north and south, and over the lecture table there is a glass-covered turret, or louver, the top of which is 40ft. from the floor. The windows of the room are completely darkened with the greatest ease by means of double curtains of blue baize, an inner and an outer curtain for each window, and these can be unfurled and furled at a moment's notice; two baize screens, one below the other, are drawn across the base of the louver. The room is ventilated, as are all the rooms in the new University building, on Mr. Phipson's plan. Pure air is drawn down a shaft in the tower by fanners, which are worked by a small steam engine. The air is passed through a dry chamber, containing hot water pipes, and is then driven mixed with any quantity of fresh cold air that may be required, into the class-room. It enters at the top of the room, and the used air is drawn off through passages below the floor.

Benches are arranged for about 150 students. They are not on a level, but rise at an angle of 25° , and beneath them there is a large convenient space, with shelves for 50 or more cells of Daniell's battery, which I shall describe immediately.

Of the other five rooms one is an additional lecture and experiment room, one is the general laboratory, one is the principal apparatus room and museum, and the remaining two are used for storing apparatus and for occasional experimenting. The laboratory is on the ground floor, and is below the lecture-room, which is on the second story. It is a room $52\frac{1}{2}$ ft. long by 34ft. broad. It has six windows, three looking north and three looking south, and these can be darkened like those in the lecture-room by means of drop curtains of baize. Three quarters of the floor is wood, the remainder concrete, covered with Portland cement; but in order to get perfectly steady tables, piers of masonry, built on the foundation, rise through the floor, and on them the feet of the tables rest. The flooring does not touch the piers at all, and thus, however much the floor may shake, the table remains comparatively steady. This arrangement gives far greater steadiness than a complete stone floor. Besides these piers there are two somewhat larger stone constructions, which are also unconnected with the flooring; one of these is intended for a large steady table; and on the other there is a massive stone erection (Fig. 1), on which is to hang a pendulum for a clock, or for experiments on the force of gravity. It is intended that the point of suspension of the pendulum shall be perfectly free from vibration.

Some of the tables are ordinary working tables. On others, instruments such as the electrometer and electro-dynamometer are set. Below the table there are frames for supporting 500 cells of a constant Daniell's battery, which were in use in the old college, and a great part of which are now re-charged.

In one corner of the room there is a wooden enclosure, which is fitted up as a small chemical bench. The ordinary reagents and apparatus for chemical testing are thus at hand.

There are large gas holders, each holding eighteen cubic feet of gas, in the laboratory. The construction of the gas-holders is the same in principle as that used in ordinary gas works. Each is, in fact, a large copper bell, with its mouth dipped under water in a deep tank. All the stop-cocks connected with the gas-holders are kept constantly enclosed in vessels full of water, in order to prevent leakage. The holders are filled at the beginning of the session, one with oxygen and the other with hydrogen, and the lime light is thus always ready.

With this brief account of the general arrangement of the premises, I shall now describe more particularly some of the apparatus and conveniences of the lecture-room and laboratory, and some of the experimental investigations going on at present.

The lecture-table in the lecture-room is 26ft. long by 2 $\frac{3}{4}$ ft. It is not straight, but made of three pieces, so as to be concave on the lecturer's side. A portion of the top of the table is removable; and when it is taken away a large trough suited for showing waves in water, and for other hydrodynamic experiments, is exhibited. The trough is as long as the table, and is 14in. broad and 12in. deep. It opens out at one end

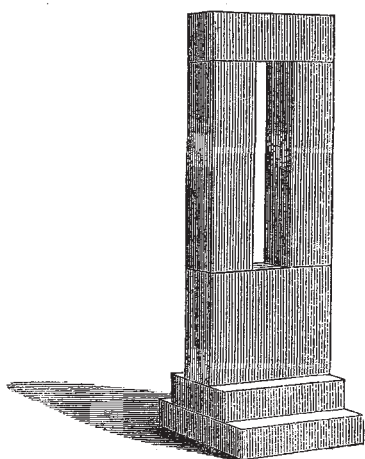


FIG. 1

into a tank 26in. broad and 20in. deep. The lecture-table is, of course, furnished with the usual supply of coal, gas, and water; and besides pipes, which give hot water and steam, are led to it. These pipes come from the boilers that heat the air with which the University buildings are warmed and ventilated. Pipes are also led to the table from the oxygen and hydrogen gas holders in the lower laboratory, so that the oxyhydrogen light is always at command at a moment's notice; and it is found a great convenience to have it so. It is used very frequently, and enables us to show to a large class many experiments which we could not attempt without it—experiments, for instance, with the reflecting galvanometer and electrometer. The preparation for such experiments generally requires much time and trouble; but with the permanent gas-holders filled once for all at the beginning of the session and always ready, the oxyhydrogen light gives less trouble than an ordinary oil lamp.

A powerful battery, which I shall have to describe immediately, is always ready. Very thick electrodes, consisting of nine ply of No. 16 copper wire of high conductivity, plaited together, pass from binding screws on the lecture-table to the battery below the lecture-room seats, and thence down to the lower laboratory.

For instruments that require a very steady support there are two pillars, one at each end of the lecture-room table. These are unconnected with the flooring.

They pass through it without touching the boards, and rest on the stone arches that cover a gateway beneath.

On each side of the lecture-room there is a clock. One of them is governed by electricity on Jones's principle; the other is an electric clock by Bain, and has a current from a single cell for its motive. The former is an ordinary eight-day clock, and is regulated in the following way:—The bob of the pendulum is a hollow coil of insulated wire. The plane of the coil is perpendicular to that of the motion of the pendulum. The ends of the coil are carried up the pendulum rod, and are connected with telegraph wires which proceed from the Observatory of Glasgow University. Fig. 2 gives a front view of the pendulum, and shows the coil and a pair of permanent magnets pointing towards the coil. When the pendulum swings the hollow coil passes over the end of the magnet at each side. Fig. 3 shows the suspension of the pendulum, which consists of two flat springs, to which the wires coming up the pendulum rod are joined. The springs are attached to insulated brass pieces, to which are connected, by means of binding screws, the wires from the Observatory. There is a clock in the Observatory which is constantly kept right, and by means of a make-and-break arrangement connected with its pendulum, a galvanic cur-

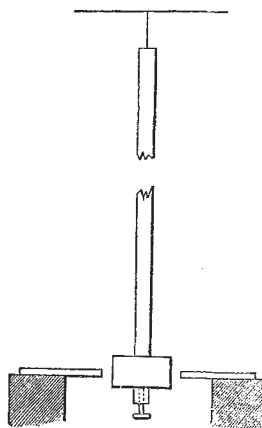


FIG. 2

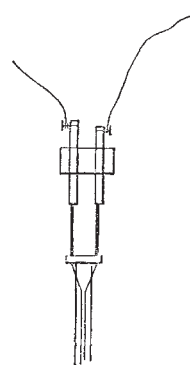


FIG. 3

rent is sent once in each second through the wire that proceeds from the Observatory, and thus through the coil at the extremity of the pendulum of the clock that is to be controlled. The coil is thus once in each second converted into a temporary magnet, and is attracted and repelled by the permanent magnets between which it swings. It will be readily understood that with this arrangement a clock that is going slightly too slow may be accelerated a little, and a clock that is going slightly too fast may be retarded a little, at each passage of the current. To be able to set the controlled clock to agree with the Observatory clock, it is necessary to have some way of distinguishing one second from another. This is done by means of a galvanoscope or indicator, which is included in the circuit, and which beats seconds with the currents. The instrument is placed close to the clock in a place convenient for comparison of it and the seconds hand of the clock. It is arranged that there shall be no beat on the last second of each minute; and that in the last minute of each hour there shall be an interval of twenty seconds without any current. Thus the ends of the minutes and the ends of the hours are distinguished.

Of mechanical apparatus almost daily employed for lecture illustrations may be mentioned various kinds of vibrators, weighted spiral springs, a Coulomb's torsion vibrator, a cycloidal and a common pendulum arranged for comparison, a friction brake, &c., &c. Over the lec-

ture-table there is suspended from the top of the louvre already mentioned a pendulum, which is intended to show the rotation of the earth. The length of it is 38 ft.; and it thus executes one complete vibration in rather less than seven seconds. In showing the rotation of the earth by Foucault's method, everything depends on perfect symmetry in the suspension of the pendulum. The suspension used here is quite new, and, I think, will prove satisfactory. I hope to take an opportunity of describing it hereafter, when I can make a statement as to results obtained.

I believe that every one who has ever had to work in a laboratory with a large battery has felt how much a powerful and constant cleanly and easily managed battery is wanted. A dozen batteries have been invented, and some of them patented within the last two or three years. Most of them are only fit for such purposes as ringing an electric bell for an instant, and even at such work as that they do not last long, and not one of them is even tolerably constant, though constancy is pretended for almost all. What is wanted is a battery that will remain constant for six months or a year without more attention than that of occasionally wiping the outsides of the cells, and replenishing them with some salt or acid and with water; and which is powerful enough for an electric light or for any other class experiment. Freedom from acid fumes is also in most laboratories an essential. A great many experiments have been made here with the view of getting such a battery as I have described, and at last, as we hope, with some success.

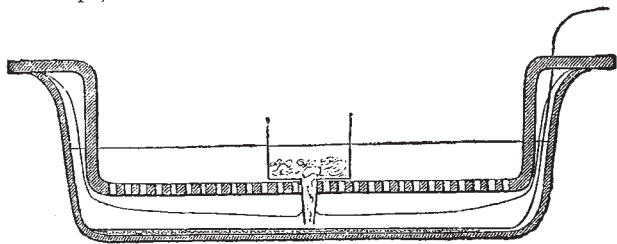


FIG. 4

Since the invention of Grove's battery, that and Bunsen's modification of it have been almost exclusively used for the electric light. These, as far as high electromotive force and smallness of resistance are concerned, are preferable to any other; but there are great objections to the use of them in the necessity for discharging them frequently, and in the emission of acid fumes, which cannot but be injurious to the person who discharges the battery, and which are very destructive to apparatus unless the battery be kept in a special chamber. The battery which we are employing in Glasgow, and which gives great promise of being really successful, is a modification of Daniell's battery.

Sir William Thomson described (Proc. R. S., Jan. 1871, quoted in NATURE of Feb. 2, 1871) a gravitation battery, in which advantage is taken of the fact that water saturated with both sulphate of zinc and sulphate of copper is denser than either saturated solution of sulphate of zinc alone or sulphate of copper alone. A horizontal copper plate being put at the bottom of the cell and a plate of zinc near the top, the cell is charged with saturated solution of sulphate of zinc, and crystals of sulphate of copper are placed in a funnel, whose delivering tube passes down to the bottom of the cell. The superior density of the solution containing sulphate of copper in addition to the sulphate of zinc, is that which keeps the sulphate of copper from surrounding the zinc plate and attacking it. This arrangement, if the sulphate of copper travelled towards the zinc solely by diffusion, would have great advantages over any in which the zinc and copper plates are placed vertically, and a porous separator is used.

It was thought that the form of cell described then would turn out admirably, and it is excellent in many ways; but it was found that a constant evolution of hydrogen takes place at the copper plate, bubbles rising perpetually from it. These cause so much stirring up of the solutions that sulphate of copper is carried rapidly up to the zinc plate, and both eat the zinc away, and it is itself wasted in depositing copper on the zinc plate. The reason of this bubbling appears to be that particles drop from the zinc on to the copper plate, and, forming small circuits there, send up hydrogen bubbles through the liquid. We have now done away with the difficulty in the following way, and we have got a cell which, so far as we have been able to test it, promises to be in all respects satisfactory. The under surface of the zinc is now covered with a sheet of parchment paper (known as manilla) the edges of which are brought up round the zinc, so that it is enclosed in a porous cell of this material. The paper, while it does not add sensibly to the resistance of the cell, acts most beneficially by hindering the particles which drop off the zinc from falling on to the copper plate; and if there are any bubbles rising from below, it prevents them from bringing sulphate of copper up to the zinc plate.

We are now employing two kinds of cells, and have forty of each kind in action. The first is very similar to that described by Sir W. Thomson in the paper already referred to. The cell is of glass (Fig. 4); and this is an advantage, as the condition of the solutions and metals which it contains may be seen at any time. It is a circular pan* with a flat bottom. The diameter is 21 inches. A disc of thin sheet copper is laid on the bottom; and a thick copper wire covered

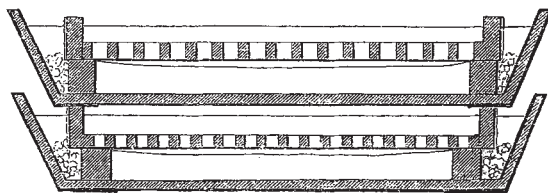


FIG. 5

with gutta percha is soldered to the copper disc and rises to the top of the cell as an electrode. In the upper part of the cell is a heavy mass of zinc, cast into the form of a circular gridiron, with three ears or projections which rest on the edges of the glass. The gridiron shape is adopted in order to permit the hydrogen, which we find constantly being liberated, to escape. The distance between the zinc and copper plates is about $2\frac{1}{2}$ in. A large sheet of parchment paper covers the under side of the zinc, and the corners and edges of the paper are brought up round the vertical sides of the zinc so as to form a kind of bag round it. The parchment paper is thus a separator between the mass of liquid in the cell and that immediately surrounding the zinc. There is a circular hole in the middle of the zinc, and the tube of a glass or earthenware funnel passes through this and through a hole in the parchment paper, the edges of which are tied round the tube, down to the bottom of the cell. The cell is then filled up with saturated solution of sulphate of zinc till the level of the liquid is higher than that of the top of the zinc; and on the top of this a layer of pure water two or three inches deep is poured carefully, so as to avoid mixing. The pure water forms an atmosphere into which the sulphate of zinc formed during the action of the battery may diffuse, and thus crystallisation is avoided. To set the cell in action crystals of sulphate of copper are put into the funnel just described. The dense solution

* The pans that we are using are, I believe, made by glass-blowers for milk pans. They are inexpensive, and answer excellently. To make the bottom horizontal we cover it with sand moistened with saturated solution of sulphate of zinc, and carefully level it by comparison with a little of the liquid lying on the top. It is essential to have it level if we wish to use up all the charge of sulphate of copper, as described in the text, to the best advantage.

flows down over the copper plate at the bottom, and in less than five minutes the cell is in full work.

We have at present forty cells such as I have just described. The average resistance of one cell is 0.19 of an Ohm. The electro-motive force of a Daniell's cell is 1.07 Volts.

The second form of cell is of the following construction. A shallow wooden tray, square, and with slightly slanting sides, is lined with sheet lead; and this, after being electrolysed with copper, forms both the containing vessel for the liquids and the copper plate of the cell. Copper trays were used at first, but they were soon eaten through by the solution. The lead is not attacked at all. The length of a side of the lead tray is 21 in., and its depth is 3 3/4 in. In each corner is set a small block of wood 1 1/2 in. high. The zinc plate, which is like a square grid-iron, rests at its corners on these blocks. The zinc has parchment paper tied round its lower surface and sides. The cell is filled up with saturated solution of sulphate of zinc, and crystals of sulphate of copper are dropped in when required round the edges outside the parchment paper. For connecting these cells together in series, the lead lining is carried over the wooden tray at the corners and down the outside to the under surface of the bottom of it. Here it is soldered to a small square of thick sheet tin. The cells are piled up one on the top of the other, the tin plates of the second cell resting on the zinc of the first, and so on. The tin connections—a suggestion of Mr. Varley—are most excellent. Two of these cells are shown in section Fig. 5. The resistance of each of these cells is on an average 0.19 of an Ohm. They are now used at all the telegraph stations where Sir William Thomson's siphon recorder is employed.

In using these batteries in a laboratory where they are not perpetually at work, the best way of managing them may possibly be not to charge them with sulphate of copper except when they are about to be used, and only to put in as much as will do the work required. To calculate the quantity is easy; and any small excess might be worked off through a low resistance. We have been keeping them at work almost night and day. They require no attention except to be occasionally supplied with sulphate of copper crystals, and to have the sulphate of zinc that creeps up over their edges wiped away with a cloth.

At present our battery is tested very frequently, generally once in four or five days. The electromotive force and the internal resistance of each cell is determined. We have now had the greater number of the eighty cells in action for three months, and some of them for five or six months. During all that time they have been most satisfactory, the electromotive force of them having remained perfectly constant.

We test them by means of the reflecting electrometer, or the tangent galvanometer.

J. T. BOTTOMLEY

(To be continued.)

NOTES

AFTER we went to press last week, a most cheering telegram was received in this country respecting the fate of Dr. Livingstone, as follows:—'Aden, May 1, 1872.—The *Abydos* has returned from Zanzibar. She brings news that Dr. Livingstone is safe with Stanley. The news is brought by natives.' It may fairly be hoped that still more authentic intelligence will shortly be received respecting the fate of the great traveller, with respect to whom such anxiety has been manifested in this country. Another despatch speaks also of the destruction of a large portion of the town of Zanzibar by a terrible hurricane on April 15.

THE eruption of Vesuvius, respecting which we gave such

details as were accessible last week, appears to be over. Whether any scientific results have been obtained by any observers besides Palmieri it is too early yet to know. We hope it may be so, and shall return to the subject as soon as the authentic accounts have been collated.

THE Annual Visitation of the Board of Visitors to Greenwich Observatory will take place on Saturday, June 1st.

THE President, Vice-President, and Council of the Pharmaceutical Society of Great Britain will hold a *conversazione* at the South Kensington Museum on Wednesday evening next, May 15.

AT a meeting of Convocation at Oxford last week, it was carried that in all the schools, except that of theology, examiners might be appointed who were not members of the University. The liberal change which had already been granted for the Natural Science School will do much to widen the general course of reading at that University, and to prevent the studies pursued there partaking too much of any narrow or special character.

MR. CHARLES TOMLINSON, F.R.S., lectures this evening at the London Institution, Finsbury Circus, on Solution and Super-saturation.

AT the Annual Meeting of the Literary and Philosophical Society of Manchester, held on the 30th ult., the following officers were elected for the ensuing year:—President, Mr. E. W. Binney, F.R.S., F.G.S.; Vice-Presidents, Dr. Jas. P. Joule, F.R.S., Dr. E. Schunck, Dr. Robert Angus Smith, F.R.S., and the Rev. W. Gaskell; Secretaries, Prof. H. E. Roscoe, F.R.S., Mr. J. Baxendell. As members of the Council, Mr. Peter Spence, Mr. W. L. Dickenson, Mr. H. Wilde, Mr. R. D. Derbyshire, Prof. Osborne Reynolds, Mr. W. Boyd Dawkins, F.R.S., Prof. Balfour Stewart, F.R.S. Few local societies can boast such a distinguished list of names as the above.

TWO Scholarships of the annual value of 30*l.* and 20*l.* respectively, tenable for two years, have been founded by the Governors of the Middlesex Hospital, for the encouragement of the study of medicine and surgery, in memory of the late Francis Broderip, a magnificent benefactor to the hospital. These scholarships will be open to competition, at the end of each winter session, amongst the general students of the hospital who shall have completed their third year of study at the Medical College. The successful candidates will be required to attend and work at the hospital for a fourth year, during which period they will be eligible for the various resident appointments.

TWO Scholarships, of the annual value of 25*l.* and 20*l.* respectively, will be offered for competition at Middlesex Hospital at the commencement of the Winter Session 1872-73. Each scholarship is tenable for two years, provided the scholar conducts himself satisfactorily. These scholarships are open to all gentlemen who commence their medical studies in October 1872. Successful candidates will be required to become general students of the College. The examination will take place on September 27 and following days, and the result will be declared on October 5. The following are the subjects for examination:—Latin, Greek, French or German, Mathematics, Natural Philosophy, Chemistry, Botany, Zoology. Candidates will be examined in any three of the above subjects they may select; but only one Modern Language and two out of the last three subjects are permitted. An equal number of marks will be given to each subject, and candidates will be expected to attain a certain standard of proficiency in the subjects they select. Candidates must send in their names in writing, addressed to the Dean, at the Middlesex Hospital, stating the subjects which they elect for their examination, on or before September 24.